Quadrature encoder

A quadrature encoder is used to determine speed, direction and position of a conveyor belt or some other device. It is a disc with a slot and two photo sensors set 90° apart, as shown in Figure 1. The two photo sensors create two square waves 90° out of phase. One could determine the direction by comparing which sensor leads. If we used only one photo sensor instead of two, we will not be able to determine the direction. Also, we will get an invalid speed and position indication if the motor was stuck and jittering around the photo sensor.

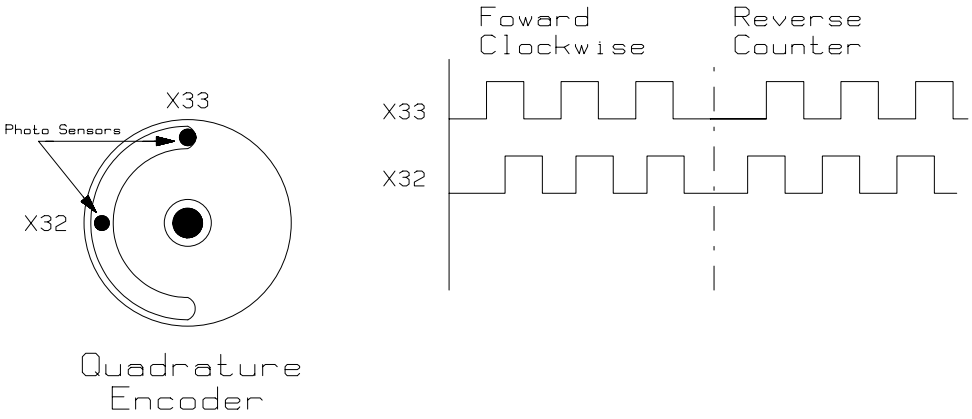


Figure 1. Quadrature encoder

Let's use a quadrature encoder to design a bottling line. The encoder will be used to measure the location of the bottles coming through the line. When a bottle passes through the photo sensor, a pulse count will be taken to determine its location. When the bottle is at the fill station the conveyor will stop and the filler will fill the bottle. When the bottle is filled the conveyor will start up and wait for the next bottle.

Assume the bottles are spaced at least one foot apart and the quadrature encoder generates one revolution per 1/16". This process is shown in Figure 2.

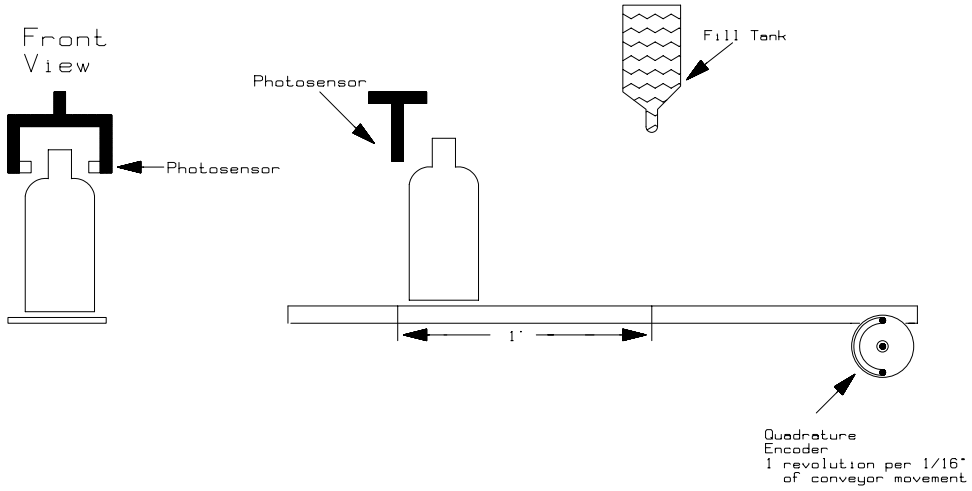
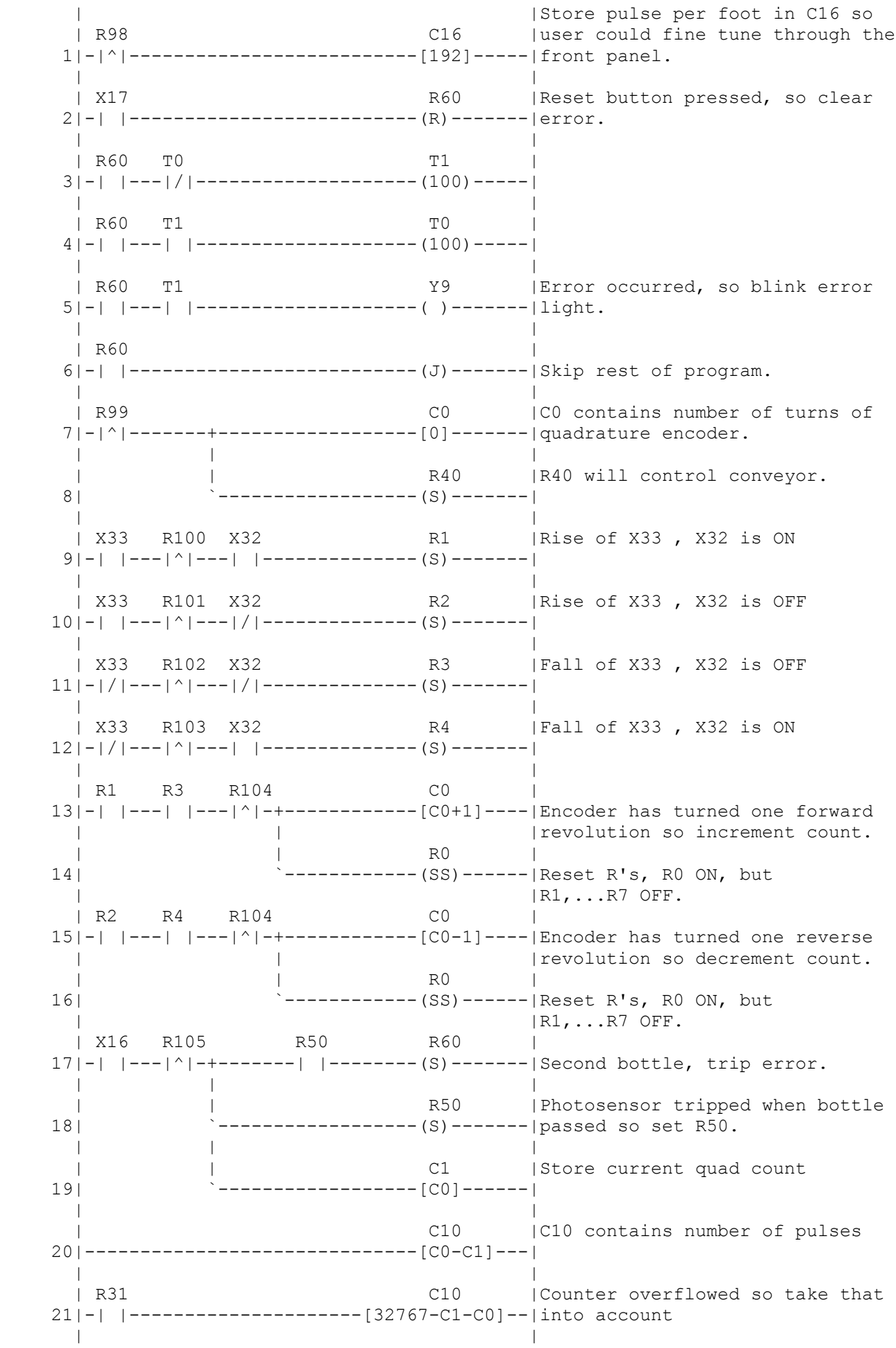
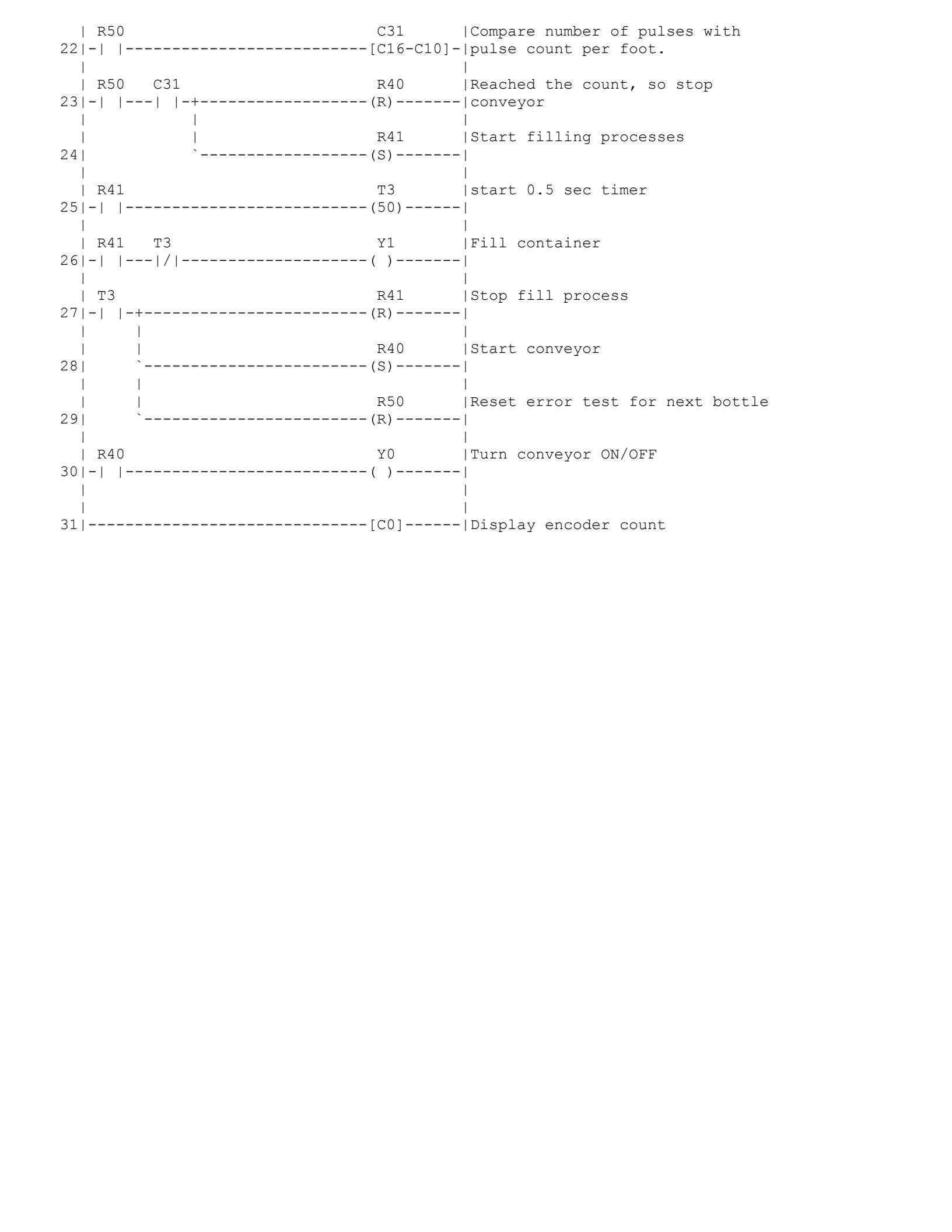


Figure 2. Bottling line

The following RLL diagram performs this operation.




R50
C31
Compare number of pulses with
22
C16-C10
pulse count per foot.
R50
C31
R40
Reached the count, so stop
23
R
conveyor
R41
Start filling processes
24
S
R41
T3
start 0.5 sec timer
25
50
R41
T3
Y1
Fill container
26
T3
R41
Stop fill process
27
R
R40
Start conveyor
28
S
R50
Reset error test for next bottle
29
R
R40
Y0
Turn conveyor ON/OFF
30
C0
Display encoder count
31